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Estimating Food Consumption from Twigs Clipped by the Abert Squirrel

David R. Patton[1]

Abert squirrels consume the inner bark of ponderosa pine twigs for food. Mean length, diameter, and dry weight of peeled twigs from a sample of 300 was 88 mm, 5.9 mm, and 1.3 g, respectively. A table gives dry weight of the whole twig, inner bark, and outer bark from dry weight of a peeled twig. Nutrient content of the inner bark is low.

Keywords: Wildlife food plants, *Sciurus aberti aberti*, *Pinus ponderosa*.

Availability of foods during winter months is probably the single most important factor controlling wild animal populations. Wildlife managers need to determine the quantity of food items consumed by an individual species and how much food will be available in the winter. In this manner the quantity of food needed and amounts available for survival are brought together under the concept of "carrying capacity." This simple principle has been the guiding philosophy in wildlife management for nearly four decades. Now, however, there is a need to understand the total role of animals in an ecosystem. The new direction does not do away with the carrying capacity concept but helps to define it in more precise terms by understanding nutrient cycling and energy flows.

The Abert squirrel *(Sciurus aberti aberti)* occupies a niche in the ponderosa pine *(Pinus ponderosa)* forest and depends on pine for food and cover. Food items of the Abert as they are currently known are composed mainly of seeds, buds, and twigs of ponderosa pine, plus acorns and fungi when they are available.[2][3] The squirrel's staple winter diet consists mostly of the inner bark of pine twigs during the period from November to April, but this depends on snow cover which inhibits ground foraging.

Clipped and peeled twigs are a sure indication that a squirrel has been feeding, and they are almost always the work of an Abert squirrel. The number of twigs clipped per day is variable, and no one has determined if the number clipped is related to squirrel numbers. However, the number of clipped twigs does indicate some unknown amount of food consumed for a given time. This study was initiated to determine the characteristics of twigs selected for food, to develop a technique for estimating the amount of inner bark consumed from a peeled twig, and to determine the nutrient content of the inner bark.

[2]Keith, J. O. 1965. The Abert squirrel and its dependence on ponderosa pine. Ecology 46:150-163.

[3]Stephenson, Richard L. 1974. Seasonal food habits of Abert's squirrels, Sciurus aberti. Eighteenth Annu. Meet. [Flagstaff, Ariz., Apr. 1974]. Proc. Suppl., J. Ariz. Acad. Sci. 9:8 (Abstr.)

Methods

The study was conducted in watershed 8 in the Beaver Creek watersheds on the Coconino National Forest, Arizona. Permanent timber inventory stakes served as plot centers to count clipped twigs that had accumulated on 189 plots (0.01 acre). Clippings were counted in June 1973; 1,219 peeled twigs were removed and dried for measurement.

A random sample of 300 twigs was drawn from the total number to get individual weights, diameters, and lengths. Another sample of 150 live twigs was cut from pine trees in September to duplicate the range in sizes found on the inventory plots (fig. 1). The outer and inner bark was removed and ovendried along with the peeled twig. The inner bark was analyzed for elements, fat, protein, and fiber content.

Results

Sixty-six percent of the peeled twigs were between 61 and 100 mm in length (table 1). The higest percentage (23 percent) were 71 to 80 mm long. Mean length was 88 mm, with a standard error of 1.4 mm and a coefficient of variation of 28 percent.

Diameters from 4 to 8 mm account for 96 percent of the twigs (table 1). Twenty-seven percent were in the 5 mm diameter class. Mean diameter was 5.9 mm, with a standard error of 0.09 mm. Coefficient of variation was 26 per-

cent. Because these figures are for peeled twigs, 2 to 3 mm would have to be added to duplicate the diameter of the twig as it would occur on a tree.

Dry weight of twigs ranged from 0.05 to just over 4 g (grams); 86 percent were less than 2 g (table 1). The mean weight was 1.3 g with a standard error of 0.05 g. Coefficient of variation was quite large at 62 percent.
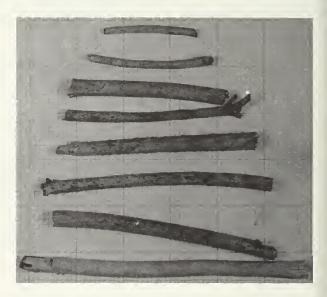

Figure 1.—Range in size of twigs collected on inventory plots. Scale: 1 block equals 2.54 centimeters (1 inch).

Table 1.--Frequency distribution of length, diameter, and dry weight of twigs clipped by Abert squirrels

LENGTH			DIAMETER			DRY WEIGHT		
Length class (mm)	Number	Percent of total	Diameter class (mm)	Number	Percent of total	Dry weight class (g)	Number	Percent of total
41- 50	9	3.0	1	0	0	<1.0	142	47.4
51- 60	22	7.3	2	0	0	1.1-2.0	115	38.3
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61- 70	39	13.0	- - - - - - - - - - - -			2.1-3.0	31	10.3
71- 80	69	23.0	4	58	19.4	3.1-4.0	9	3.0
81- 90	46	15.4	5	81	27.0	4.1>	3	1.0
91-100	43	14.4	6	62	20.7	Total	300	100.0
- - - - - - - - - - - -			7	57	19.0			
101-110	21	7.0	8	30	10.0			
111-120	16	5.3	- - - - - - - - - - - -					
121-130	18	6.0	9	4	1.3			
131-140	7	2.3	10	5	1.7			
141-150	6	2.0	11	1	.3			
151-160	4	1.3	12	1	.3			
Total	300	100.0	Total	300	100.0			

(length 61-100 bracket: 65.8; diameter 4-8 bracket: 96.1; dry weight <1.0 and 1.1-2.0 bracket: 85.7)

Linear regression equations were computed from the 150-twig secondary sample to estimate weight of inner bark, outer bark, and total weight of peeled twigs to total twig weight (table 2). This sample had been cut from pine to simulate twigs removed by squirrels. All the equations had a correlation coefficient greater than 0.90.

Table 2.--Dry weight (g) of inner and outer bark and total twig weight, estimated from dry weight of peeled twigs

Peeled twig	Inner bark	Outer bark	Whole twig
0.5	0.13	0.69	1.32
.6	.15	.76	1.51
.7	.16	.83	1.69
.8	.18	.90	1.88
.9	.20	.96	2.06
1.0	.21	1.04	2.25
1.1	.23	1.11	2.44
1.2	.25	1.17	2.62
1.3	.26	1.25	2.81
1.4	.28	1.31	2.99
1.5	.30	1.38	3.18
1.6	.31	1.46	3.37
1.7	.33	1.52	3.55
1.8	.35	1.59	3.74
1.9	.36	1.66	3.92
2.0	.38	1.73	4.11
2.1	.39	1.81	4.30
2.2	.41	1.87	4.48
2.3	.43	1.94	4.67
2.4	.44	2.01	4.85
2.5	.46	2.08	5.04
2.6	.48	2.15	5.23
2.7	.49	2.22	5.41
2.8	.51	2.29	5.60
2.9	.53	2.35	5.78
3.0	.54	2.43	5.97
3.1	.56	2.50	6.16
3.2	.58	2.56	6.34
3.3	.59	2.64	6.53
3.4	.61	2.70	6.71
3.5	.63	2.77	6.90
3.6	.64	2.85	7.09
3.7	.66	2.91	7.27
3.8	.68	2.98	7.46
3.9	.69	3.05	7.64
4.0	.71	3.12	7.83

The inner bark from the twigs clipped in September was low in protein (4.6 percent) and fat (7.0 percent), but was high in fiber content (41.7 percent). These figures indicate the inner bark is not very nutritious at least in September. A continuous diet of twigs, without supplemental foods, would put a squirrel in a weak condition susceptible to death from weather extremes. Elements in the inner bark sample, in p/m (parts per million), were:

Nitrogen	6,700
Phosphorus	900
Potassium	4,300
Magnesium	1,620
Calcium	6,300
Sulfur	300
Zinc	42
Manganese	103
Iron	111
Copper	17
Boron	22
Sodium	400

With the data obtained in this study it is possible to estimate the amount of inner bark consumed by the Abert squirrel. The litter that resulted from removing a whole twig can be estimated at the same time. This litter eventually will decay and be returned to the ecosystem as nutrients.

As an example, Keith (1965) estimated that an Abert squirrel can clip 50 twigs a day to get the inner bark. The average weight of a peeled twig from the sample of 300 was 1.3 g. This weight converts to 0.26 g of inner bark and 1.25 g of outer bark. For 50 twigs, the average weights, in g, were:

Inner bark (food)	13.0
Outer bark (litter)	62.5
Peeled twigs (litter)	65.0
Total	140.5

Thus the squirrel actually consumes less than 10 percent of the weight of the twigs it clips.